

5    We claim:

1. A method of creating an atrioventricular bypass tract for a heart, comprising:

10                 growing mesenchymal stem cells into a strip with two ends;

                     attaching one end of the strip onto the atrium of the heart, and

15                 attaching the other end of the strip to the ventricle of the heart, to create a tract connecting the atrium to the ventricle to provide a path for electrical signals generated by the sinus node to propagate across the tract and excite the ventricle.

2. The method of claim 1, wherein the steps of  
20                 attaching are performed by suturing.

3. The method of claim 1, wherein the stem cells are adult human mesenchymal stem cells.

25                 4. The method of claim 3, wherein the step of growing comprises growing the stem cells in culture on a non-bioreactive material.

30                 5. The method of claim 4, wherein the step of growing is performed in an environment substantially free of any additional molecular determinants of conduction.

35                 6. The method of claim 1, further comprising a step of adding a gene to the mesenchymal stem cells by electroporation.

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7. The method of claim 6, wherein the gene encodes for a connexin.

10 8. The method of claim 7, wherein the connexin includes connexin 40.

9. The method of claim 7, wherein the connexin includes connexin 43.

15 10. The method of claim 7, wherein the connexin includes connexin 45.

11. The method of claim 6, wherein the step of adding a  
20 gene by electroporation includes adding alpha and accessory subunits of L-type calcium.

12. The method of claim 6, wherein the step of adding a  
25 gene by electroporation includes adding the gene for connexions and adding alpha and accessory subunits of L-type calcium channel.